REPORT ON COMMUNICATION STUDY

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This report is submitted in compliance with instructions from the Office of the Chief and the material outlined in "O(E), STUDIES, Communication Systems," circular O. No. 233, of June 7, 1944.

Source of Data

Data was secured from records in Regional and Supervisors' offices and by field contact with Regional Office representatives, Supervisors, Rangers, Guards and other personnel and by check and observation of communication facilities and operations on the following forests:

Region 1
Kaniksu; Coeur d'Alene; Lolo *

Region 4
Boise; Payette

Region 5
Los Padres, Angeles; Sequoia; Tahoe; Eldorado; Klamath

Region 6
Siuslaw; Wenatchee, Radio Laboratory

*Brief field study.

Foreword

Communication, being of an intangible nature, its value cannot be measured directly in dollars. The importance of communication in the Forest Service can possibly best be appreciated by assuming the extreme view of elimination of all wire and radio service. Obviously, administration would be seriously impaired, present fire detection and suppression practices would be entirely impossible and the effectiveness of other activities would be minimized if not completely mullified. The need for communication is accordingly not questioned but one of the first questions to be answered in connection with forest communication is "what constitutes an adequate system"?

A telephone system that was adequate fifteen years ago is now hopelessly insufficient. The added work load of an enlarged forestry program, the recession of high values into areas that were then completely remote and considered as having little value, the technical problems brought about by the extension of power transmission lines (particularly ground return systems) into forest areas and the demand for increased speed of action in most fire protection areas has brought about the need for improved dependable communications.

A measure of the degree of adequacy of telephone and radio systems must include:

(a) Consideration of investment
(b) Period of service (year long or seasonal)
(c) Forest and other values
(d) Fire and administrative needs (hour control, report time)
(e) The ability, financially and otherwise, to maintain (technically) the system

The fact that for the four regions studied the telephone plant investment alone is approximately 8 million dollars is some indication of the magnitude of communications as a service-wide activity yet as of today we approach our communication problems in a most inefficient and unbusinesslike manner.

Briefs of Field Observations

(a) Communication planning varies by regions as to completeness and detail.

(b) The physical telephone plant constructed in accordance with plans soon loses its identity through additions of instruments, extensions, poor maintenance and cumulative deterioration.

(c) Local attitude toward communications, instead of service-wide policy and standards, now determines the quality and success of Forest telephone and radio systems.

(d) Lack of adequate maintenance allotments is resulting in cumulative deterioration to the point of abandonment or reconstruction of lines instead of maintenance to a constant standard. Service and reliability fall off and trouble shooting increases in proportion to the degree of deterioration. Contributed time carries the major portion of telephone maintenance cost. (This cannot be confirmed by current cost records, but represents the opinion of a large number of officers contacted on ranger districts.)

(e) Construction of pole lines by untrained crews results in numerous early physical failures.

(f) Lack of competent technical communication personnel is resulting in excessive expenditure of time by Rangers and similar personnel on technical trouble shooting and in unreliable communications through failure to secure maximum service from existing facilities.

(g) Telephone materials, accessories and construction practices are not standardized. Switchboards vary from commercial cord and keyboards to home-made entanglements of scrap wire and switches installed in a desk drawer. Each is expected to provide the same class of service. Telephone lines vary from the best commercial practice to unsurveyed locations with substandard and

unreliable construction, again in use for the same class of service.

(h) Telephone and radio communications are poorly coordinated. Radio is most often found to duplicate telephone service rather than extend it. Many long-haul lines carrying one or two telephones are maintained annually for seasonal service only, without consideration to the use of radio.

(i) The Telephone Handbook is obsolete in certain technical phases and in incomplete, particularly as to coverage of the entire problem of metallic line construction. A stronger, more complete Handbook copying strongly in form some of the very excellent training and instruction literature prepared by the military and Bell Telephone Company would assist in minimizing errors and undesirable practices.

(j) Of the few technicians now employed, at least one half are incompetent. Radio equipment servicing now consists largely of experimenting and tinkering.

(k) Training of field personnel to use radio varies from moderate to no training with the result that 50 to 75 per cent of all radio communication failures are attributable to the user. (Item C, "attitude," is intimately related to this problem."

(l) Improper types of radio are chosen for specific applications. Portable SX radiophones were seen in service as the only means of lookout communication while type T sets remained stored in the Regional warehouse.

(m) There is need for a relatively new class of VHF radio equipment to take full advantage of this form of communication and to move radio directly into the field, as opposed to centralized and purely emergency use, where it can provide not only emergency service but be used in the daily work of the field force regardless of static conditions or time of day. These sets would be more simple to operate with fewer dials, switches and gadgets.

(n) Lack of planning both utility and use was observed in radio cars and trailers being equipped with various types of radio and set aside for the "big fire" Equipment, both radio and motor is tied up and seldom used.

Discussion

There is one basic reason for all faults observed -- lack of leadership and a positive program on a service-wide basis.

Not only each Region but each Forest and District devises its own standards, procedures and practices, based largely on local attitude toward communications. This does not mean that there is general disregard for the Telephone Handbook. The Handbook is primarily a mechanics guide and accordingly does not serve as a substitute for policy and an intelligent program.

An example of the lack of service-wide leadership is the present complete lack of uniformity in setting up the class of construction to be used in building a telephone line and in the future maintenance of that line.

For instance, Region A now builds most of its trunk lines and many lookout lines to commercial or near-commercial standards. Region B with the same general physical protection problems and with possibly even greater forest values builds substandard lines and continues to shout over these lines and to patch and splice throughout the fire season. Region B has a smaller initial investment, a lower apparent maintenance cost (at least under the present system of low grade maintenance and the ease of concealing actual maintenance cost in 'contributed time' on grounded and substandard lines that can be maintained by road and trail crews), but has a system of very low reliability.

We now allow each subdivision to set its own price on reliability and to establish its own standards for the overall performance of the communication plant. If there was some semblance of uniformity in these decisions they could be dismissed as unimportant and selfadjusting but this is definitely not the case. The above example points to a possible middle ground where opposite extremes can be avoided yet currently we allow these costly and important decisions to be made without guidance.

Maintenance practices on Ranger Districts with similar physical and fire problems vary in the extreme. They cannot all be right. Some are expending money in maintaining lines of questionable value while others neglect to provide essential communication.

The exact details of local problems cannot be decided on a service-wide basis but service-wide policy as to classification and standards of communication and its maintenance, including the development of criteria for basic communication planning, the proper integration of radio and commercial facilities into the system, and the setting up of Regional machinery to correlate and guide the application of these policies will result in elimination of wasteful and costly practices and in a tremendous improvement in the utility value of the Forest Service communication system.

~~(a)~~ Planning + Control

This study confirms the necessity for increased coordination and complete understanding and agreement, as to need and methods of execution, between all units and divisions whose work involves the use of proposed communication facilities.

Communication plans on file in Regional Offices are usually signed for concurrence by various divisional representatives and the Forest Supervisor yet there seems to be lack of complete understanding as to the accomplishments of the plan. Whether, through lack of interest, the concurrence is a formality, or the technical aspects of the plan are not clearly understood for lack of proper interpretation and thus obscure the practical objectives of the plan, the fact remains that most plans are too highly individualized, bearing strong resemblance to the ideas of the individual, who prepared the plan. Such plans are accordingly too narrow in point of view to cover all needs, both current and future, in the most expeditious and economical manner and are subject to early and recurrent revision.

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Each of the Regions visited had a Regional Communication Officer. In two of the Regions these positions are under the supervision of Engineering and in the other two are under the supervision of Operations.

Lack of a clear cut servicewide policy of procedure has left these men to pursue their own or the local divisional interpretation of the job. On the whole these jobs are not contributing their maximum possible service. In too many cases the communication officer has become ~~of~~ an office specialist while the field goes literally barefoot for lack of guidance and assistance with numerous problems.

Plans set up for long-time execution are almost totally worthless under the present system of communication organization. During the extended period of execution of the plan, many local field problems arise and if funds are not available to permit completion of that part of the plan which would answer the problem at hand, then some temporary expedient is used as a stopgap and is handled on the ground with little or no reference to the eventual execution of the original plan. Such measures gradually nullify the plan and continue the telephone plant as a piecemeal patch-and-build project.

This fact is verified to a large degree by contrasting the processes in Region 5 during the period 1934-37 to that of the other Regions studied. During the period referred to, Region 5 planned and followed up by immediate execution the improvements in their telephone plant that have resulted in an acceptably adequate telephone system on several forests. Plans made by certain other Regions at about the same time, but not then executed, are now entirely worthless, not only because of changing conditions and requirements, but because the existing system upon which the plan was based has changed to such a degree that replanning is now necessary.

A definite and standardized maintenance program with sufficient financing for execution is essential to putting communications on a businesslike basis. With this as a basis we can aim at one of the guiding principles for Regional communication planning--"Can the proposed physical communication plant be maintained?" Very definitely more consideration should be given during the planning stage to the matter of recurrent costs in connection with the proposal. The construction of a high quality system with attendant increase in cost of maintenance materials must be carefully weighed against the opposite extreme of "haywire" that consumes funds in the form of labor for constant trouble shooting and at the same time fails to provide reliable service.

If the planning groups and acceptance officers will keep these facts in mind, it is believed that the problems brought about by underbuilding or overbuilding will be minimized by local action.

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Local attitude toward communications is now the principal factor in setting the standards of service secured. This is particularly true in the case of radio where a moderate amount of extra effort is required to introduce this kind of communication and to train the users. This cannot be better illustrated than by the case of one Region in which the administrative officer in charge of communications is definitely prejudiced against radio. Throughout this Region, with the exception of one forest, radio is largely a plaything Its application and integration into the overall communication picture has been neglected and in most cases it parallels wire service where actual necessity does not exist and if it fails to operate, no serious damage is done. Consequently, a high percentage of sets do fail to function both for reasons of poor technical maintenance and primarily for lack of training of the field force. In the case of the exception noted (there may possibly be others in this Region, but they are in the minority), the Supervisor had a job to be done by the radio equipment and it accordingly was being done. On a trip across the forest, every station called responded immediately and in a concise businesslike manner.

Telephone lines are now rolled up and again rebuilt over the same general route with changes in forest and district administration.

Maintenance on some districts is now as good as can be expected under limitations of manpower, funds and technical assistance while other districts with similar forestry and protection problems have extremely poor wire and radio service.

These costly and inefficient procedures can be corrected by standardizing and controlling communications on a Region-wide basis. There is hardly an exception to the fact that radio and telephone facilities are poorly coordinated.

Largely through lack of a thorough understanding of the possibilities and limitations of radio, and through lack of training and adequate technical aid in selecting, distributing and maintaining radio equipment this form of communication has not been assigned a place of responsibility in the communication system.

In many cases radio merely parallels an existing wire service as an alternative means of communication. In some cases it is used more extensively than the wire circuit which it parallels; in other cases it is used only as an emergency device.

There is no question but what Forest Service radio equipment to date has had both physical and technical limitations that prevented its adoption as a general telephone substitute. It has, however, had exceptionally high use value within its sphere of application as has been thoroughly demonstrated on certain forests where it was applied plan wise, with a specific objective in mind and with preparation in training and maintenance.

Some Regions have failed to realize more than a fraction of the value available from this tool even in fire emergency communication. In some instances the Regional centralizing of communication through use of radio has received detailed attention while "on the forest" radio communication has been almost completely neglected. A guiding policy for integration of radio into the overall communication system is necessary. The matter of securing maximum use from radio was given special attention in this study and as an outcome, we now have field recommendations for certain types of new radio equipment to fulfill the service requirements of a revised and widened field of radio application in forest communication. These recommendations are discussed under a separate heading.

Several cases of experimenting and tinkering by telephone-radio technicians were found. In every case the equipment involved had been lessened in efficiency or the work was not pertinent and was primarily a matter of personal amusement.

An example of this tinkering was found in one Region where someone, technician or administrative officer, had designed a so called PD antenna and then proceeded to accept bids for several hundred. Subsequent tests by the Radio Laboratory indicated some 30% efficiency which was further reduced by a poor soldering job which in most instances would ground out the signal. This was done in spite of very complete drawings (36B) in the Radio Handbook dated 8-26-41.

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Lack of adequate channeling of field requirements into the Radio Laboratory for interpretation into practical equipment has retarded the overall radio program.

Aside from technician experimentation for the sake of experimenting there is the tendency for each Regional communication group to fulfill some specialized local problem not met by regular Fort Service radio equipment, by design of special gadgets. Unfortunately these practices usually consume an extreme amount of time that should be applied to urgent field problems.

All such special technical problems should be submitted to the Laboratory. If a special Laboratory project is not warranted because of limited or highly localized need at least the technical advice of the Laboratory should be sought to prevent duplication of effort. Currently this is not being done.

Extremely unworkmanlike and unreliable installations were evident and on the whole the radio system was earmarked strongly by amateur hobbyist methods.

This tendency to experiment exists to a large degree in the average radio technician and without training and general supervision as to compliance with a prepared program, only a small part of the value of such personnel is now realized.

The matter of selection of proper equipment to perform a specific job, either telephone or radio, is now as varied as are the types from which to choose. Results secured vary accordingly.

A large part of the dissatisfaction with radio now comes from improper selection of equipment as is well illustrated by the case of an SX radiophone installed on the fire wall of a pumper truck. The tubes in this set will stand severe shocks and jolting but will not withstand high rate vibration as received from the motor of a truck. Accordingly, when the set was removed for inspection it was found to be inoperative.

It would be unreasonable and uneconomical to attempt to set down an inflexible single standard of construction for telephone lines and constituents of radio networks to cover the varied needs of forest communication. It is equally unsound to continue the "hodge-podge hit-and-miss" selection of line wire, pole hardware, insulators, drop wire, switchboards, lightning protection, underground cable and other accessories that are common to most systems.

It is found that some Regions have made use of heavier-than-average copper clad steel line wire with long span construction and increased pole spacing. The results appear to be entirely satisfactory and the procedure accomplishes a reduction in initial pole cost and replacement that more than offsets the slight increase in wire cost. A complete analysis of such use should be made by every communications officer before offering a construction plan for acceptance.

Although lightning protection devices are usually found to conform with the existing handbook standards the methods of application and installation and the combining of the various types for maximum protection varies in each Region. There is a best method for each kind of circuit and this should be found and generally adopted.

Switchboards are possibly the best example of nonuniform practice. There is hardly a Region that does not have at least a half dozen homemade versions of a telephone switchboard--some good, others extremely poor. A variety of commercial boards are also in use--some cord, some key, and some combination units. Maintenance alone is complicated manyfold by this variety, not only in acquaintance with the board, but also in the matter of the large number of parts which must be stocked for repair service.

Since, in most of the Regions studied, the major source of telephone trouble lies in the terminal equipment, i.e., installation of instruments, repeat coil, switchboards, and cable entrances, it seems that this is a most opportune time to standardize on simplified modern switchboards and accessories before a "house cleaning" program is initiated.

Most of the Regions now spend considerable time in designing and building switchboards with resultant duplication of effort and the further enlargement of a hybrid system.

It is recommended that the telephone men in the various Regions submit their proposals for standardization of boards and other accessories and that these ideas be combined into new standards for the Telephone Handbook.

As has been previously pointed out, current radio equipment has certain physical and technical limitations that have prevented its full adoption as a work tool.

Specifically the type SPF radiophone, which has served admirably as an emergency fire communication tool, is not suitable for single man smoke-chaser work due to excessive weight. The need for a relatively long antenna and some prior training in the operation of the set has further minimized its field of application. Due to discontinuity of service during lightning storms, fading with changing times of day, and inability to secure economical 24-hour service, it has not been possible to rely on this and similar equipment as a telephone substitute at any point of primary importance.

Our experience over the past few years with VHF (30-40 megacycle) radio shows that the fading and static problems do not exist on these frequencies. We have not, however, removed the other obstacles of weight and proper physical form in VHF portables and of maximum physical and electrical reliability together with economical 24-hour service in the lookout or fixed station units.

of the use of ~~radio~~ such radio equipment

The following hypothetical case and discussion was presented to numerous field men and rangers in each of the Regions and without exception, it was enthusiastically received as one of the most important application for radio.

1. Install from two to five fixed lookout radiophones on prominent lookout points on each district (the number depending on topography, area and degree of coverage required. It is estimated that from 75 percent to 90 per cent reliable coverage could be obtained on the average district with from two to five installations.), primarily to serve as inlet stations for portable and mobile field-going units.

   This basic distribution of stations would provide the means by which smokechasers, work crews and administrative personnel on field projects could be kept in contact at practically all times. The greatest benefits in providing this communication would be to increase the flexibility of standby and work crews during fire periods and in orienting the smokechaser, particularly in the case of hard-to-find fires.

   The daily work of the ranger could also be modified and extended especially during fire season if he could be reached at any point in the field.

   The equipment recommended for the service would incorporate the best reasonable practices known to secure reliability, would provide for local operation much as a telephone instrument, would be capable for serving as an automatic repeater (primarily for early season use prior to manning the lookout point) and would provide for remote control operation over a telephone circuit.

This basic network would be fed directly into the ranger district office preferably over a reliable telephone circuit from the nearest prominent lookout point.

2. Install the lookout type unit just described on all regular lookout points now served by long spur lines. The elimination of long lines carrying one or two telephones for seasonal use only is currently consuming a large part of the manpower and funds available for telephone maintenance. Elimination of these lines would allow better maintenance of the basic telephone plant which should not only be continued but should be improved in service. By "basic telephone plant" is meant district, interdistrict, and district to Supervisor year long trunk lines and those that can be adequately and economically maintained for the seasonal detection system.

3. Provide a lookout-fireman pack type radiophone for those emergency points manned only during high hazard periods and in special cases to cover secondary areas that may be "radio blind" to the basic system.

   The set recommended for this service would be patterned along the lines of the present experimental SY radiophone.

4. The third unit of new equipment needed to enlarge the utility of radio is the light-weight set designed specifically for addition to a fireman's or smokechaser's pack and simplified to the point of having only an on-off switch and a push-to-talk button on the microphone. Through simplification of operation the need for prior training will almost entirely disappear and reliability will be improved by elimination of the complications which now contribute to unreliability and failures.

   Field men generally were heartily in accord with this proposal for a more intensive daily use of radio communication "on the job". Each stressed the necessity for simplicity in portable sets and maximum reliability by whatever means might be necessary to achieve this objective.

   It is believed that the Radio Laboratory now has a sufficient background of accumulated experience with VHF radio to produce the desired equipment.

Maintenance

Current allotments for telephone maintenance range from $3.50 to $8.00 per mile with few lines allowed more than this amount. Contributed time estimates are approximately 10 per cent.

Under present bookkeeping procedures it is not possible to determine the exact cost of line maintenance. Without exception, field estimates indicate that where some small attempt is made to actually maintain (not merely patch and splice), the cost runs from two to seven times the actual allotment.

The estimated annual maintenance cost per mile for continuation to original standard, as secured from one of the Regions, follows:

Grounded Tree - $ 5.70
" Pole - $29.65
Metallic Pole - $59.05

Road and trail as well as other funds contribute heavily toward maintenance of the telephone plant through the indefinite item "contributed time."

At present we do little or nothing more than patch and splice our telephone lines. Preventative maintenance is practically unknown. The plant continues to deteriorate until rebuilding is the only answer to continued use.

Again we do not have figures to confirm an opinion, but there is no other item of equipment or facility that has proven economical in use if allowed to break down, fall apart or wash away and then be replaced by something new. Automobiles, tractors, roads, trails, and water improvements are not economical investments if a certain amount of preventative maintenance is not applied. There is no doubt that a telephone plant falls in the same classification.

An outstanding need is a service-wide standard of classifying those lines to be maintained to original standard and those to be maintained at reduced standards and at the option of local administration. Positive financing and improved operational service will result.

Currently many telephone lines are maintained if time is available, if funds are available, and in too many cases, if the inclination exists. This is not only indicative of the orphaned condition of forest communications but points to the need of classifying all trunks and key detection circuits into "musts" for maintenance or the elimination or modification of the facilities.

Due to power line interference problems there is increasing need for replacement of many grounded circuits by metallic construction. The building of such facilities by untrained crews under supervision of foremen without telephone construction experience is resulting in errors that cause unnecessary structural failures and in slow progress of the work. Region-wide these factors are important items affecting cost and reliability of service.

In all Regions visited, a Regional communication officer was provided. These men have for the most part been busying themselves with little things, and possibly through lack of constructive supervision, been allowing such things as plan preparation, plan execution, plan modification, technical supervision, technician and operator training and maintenance programs to either drift along with slight attention or to their complete neglect. These positions are, in two Regions, under the supervision of Engineering and in the other two under the supervision of Operation. Guidance and technical advise is being secured from Engineering in one of these latter two Regions. No doubt a detailed analysis of the office time of these men would indicate that, it was a large percentage of their total time and that very little resulted from such an expenditure. Such things as carrying on detailed experiments of radio equipment in the office or trying to determine where one type of gear will work by a study day after day of the maps, the preparation of formulas, the making

of detail sketches, and the building up of radio and telephone shops beyond any sound reason take time, and while they are being done the field is literally barefoot in so far as knowledge and use of radio gear is concerned. These men together remind one of a poorly trained and coached football team who do a lot of fumbling, some kicking, but are usually on their own goal line.

Some of this experimental attitude on the part of the communication officers can be tied directly to the failure of the Radio Laboratory to keep abreast of field requirements. This is not altogether the fault of the Laboratory since they were concerned for many months with the manufacture of radio sets for A.W.S. Many of the types turned out by the Laboratory are not satisfactory for field use; they are cheaply built (lack stability); they are unwieldly to carry or too heavy. They were designed for installation under certain conditions and tried to fit in another Region under other conditions. The experimenting is largely because of these faults which the field men are trying to overcome.

Some failures to take advantage of radio is also tied closely to design of sets. Every different type is packaged in a different size and shape box. Some equipment should be standarized and be made to fit into a radio type cabinet. Much difficulty is being experienced with moisture gathering on wires and equipment inside the sets. This is a problem which the Laboratory will need to overcome, probably with the help of the Forest Products Laboratory, in sealing out moisture and making possible the leaving of sets installed year round.

Observation backed by the opinion of numerous forest officers indicates that an extremely large amount of time is spent each day, on every forest, in technical trouble shooting on the telephone system. Lines that fail to "talk up" even after complete check of the physical line, power line interference, cross-talk, switchboards decommissioned by lightning and similar technical ills contribute toward this investment of time.

It is not unreasonable to believe that the full time of at least one man is now so consumed. Unfortunately this is made up of time contributed by Rangers, alternates, Key Guards and others who should be relieved of such duties for which they are not prepared or equipped and on which they operate strictly by "hunt and peck". Such operations are not only inefficient and costly but the corrective measures applied are often temporary and contribute to further deterioration of the system.

Even the emergency repair of radio equipment is usually beyond the capabilities of the average field man and if radio is to contribute its maximum value to forest communications it must be adequately maintained. Some of the more complete communication plans consist of descriptive material giving routing, switching and line load data for all circuits. Through lack of adequate mainte-

nance and poor technical servicing, many (actually most) such lines have deteriorated to a point where the actual service and transmission characteristics of the line are less than half of that indicated by the plan. The answer to these problems reverts to the need for a coordinating officer who will plan and control the overall system in accordance with service-wide and Regional policies and standards in place of allowing the growth of dozens of "personalized" telephone systems in each Region.

Recommendations

(1) The Regional communication position be enlarged in scope to serve as a centralized coordinating point for plan preparation, plan execution, plan compliance, plan modification, technical supervision, technician and operator training, supervision of construction and maintenance programs, integration of radio and commercial wire facilities into the system and to secure the fullest and most complete use of the communication facilities now available. Those chosen for this enlarged position must have a moderate but sound telephone and radio technical background but by far the most important qualification is a broad knowledge of the problems of forest protection and administration. By the nature of the personal interests of an engineer or technician, such a man would seldom be capable of fulfilling this position successfully. Conversely, the administrative man without technical background would be handicapped in making technical recommendations or even to supervision of the work of field technicians. The success and value of the position recommended lies largely in the individual selected who must have a broad and impartial view of both telephone and radio without prejudice or undue enthusiasm toward either.

(2) Forest communication planning committees be established (Supervisor and two members of his staff or Rangers) for the purpose of reviewing initially the forest communication requirements and later to accept or modify requests from ranger districts for additions or changes in communications. Minor changes or additions recommended by this committee would be acted upon directly by the Regional Communication Officer. Major construction or alterations to the plan would be submitted by the Communication Officer to the Regional Communication Board.

(3) Regional Communication Board to be set up. This board should consist of representatives from Fire Control, Engineering, and Operation or be so modified as to represent the principal users of a communication in the Region.

It would be the function of this board to review all communication plans and to recommend to the Regional Forester for acceptance or rejection, based on Region-wide plan coordination, necessity, financing, and selection of alternative methods. Factual data, the physical plan, alternative methods and cost estimates would be submitted to the Board by the Regional Communication Chief. In case of disagreement or rejection of a forest proposal, the Forest Supervisor should be heard by the Board.

Regardless of the degree of planning, forest telephone systems gradually lose their planned identity through the addition without Regional control of such items as *"convenience telephones," unplanned spur lines and loops and cumulative deterioration, instruments, howlers, and switchboards until the lines become overloaded to the point of complete failure.

The addition of other loads without reference to the plan or alternative methods or circuits is now practiced to the detriment of all service on many lines.

Regional centralization of control of communications under a communication officer who will secure compliance with acceptable standards of work and a well thought out program will largely correct the present inefficiency and confusion.

(4) All forests, except those with below average telephone mileage and few radiophones, secure combination telephone-radio technicians. It would be the duty of such a technician to correct and maintain in order all technical faults in the telephone system such as repeat coils, grounds, transpositions, leaking keys and jacks on switchboards, lightning protection installations, installation of all instruments, phantom and control curcuits and to make instrument tests in case of line failures to quickly locate faults.

The technician must also be capable of making correct installation of all permanently located radio equipment, maintain the equipment in proper repair for maximum service and reliability and instruct and train forest personnel in its proper use and operation.

The selection of the proper man for such a job is not easy. In those places where similar positions now exist the tendency of the technicians is to experiment and in some cases to be more detrimental than helpful especially in the case of radio. This is in a large measure, due to lack of a positive program and competent supervision. The technical aspects of the job are of such a nature that the average forest officer is unable to judge the qualifications and performance of specialized technical personnel except possibly on a long-time basis.

If the technician is to contribute substantially in carrying out this important job, he must be held strictly accountable in the matter of standards, methods and quality of performance to the Supervisor who in turn will be held accountable, as always, to the Regional Forester, the Regional Communication Officer acting as his agent.

*"Convenience telephones" are those that are usually found at Ranger Headquarters plants varying in number from a few up to sixteen or eighteen.

(5) Field technicians be assigned to the Radio Laboratory for a period of approximately two to four weeks at least every two years. This contact will permit technical training of the technician in processes and procedures in connection with radio equipment maintenance and will bring field problems into the Laboratory for solution by the most direct route.

(6) Training, not only of radio technicians and operators, but also of telephone construction and maintenance crews, is extremely weak. It is ~~further~~ recommended that telephone and radio training aids and a basic communication training program be devised for service-wide guidance.

(7) Each of the Regions organize a Regional telephone construction crew consisting basically of two experienced telephone line construction men. The balance of the crew to be recruited from existing personnel.

This crew would operate under the immediate supervision of the Regional Communication officer on a long-time schedule of new and reconstruction based on urgency as recommended by the Regional Communication Board.

(8) The Radio Laboratory be instructed to proceed with the necessary experiments and design of the three types of sets suggested and concurred in by the field(Rangers, Supervisors, Guards, etc.).

(9) After the sets have been designed and built in sufficient number that each of the major radio-using Regions set up one or two forests for thorough trial of the equipment as soon as it becomes available. The matters of equipment selection, planned distribution, installation and preliminary testing on these trial areas only should be carried out in close cooperation and with the assistance of the Radio Laboratory in order to assure the maximum service from the equipment and to serve as samples for future installations.

Renumber paragraphs GS necessary

(10) The Radio Laboratory enlarge its vision continuously by field investigations through assignment of radio technicians to field problems.

(11) The Radio Laboratory be supplied, at the Laboratory with stenographic service to provide for quick answers to technical questions received from field technicians. Laboratory not being used to full extent intended for this reason.

(12) The practice of Region 6 assessing a levy of seven per cent on radio purchases be discontinued. This seven per cent is for typing only of bids, purchase orders, billing other Regions for the amount of the purchase. The cost to Region 6 on a $10,000.00 order does not exceed $50.00. The specifications are now written at the Laboratory and all equipment is received there.

(13) It is questionable if the Laboratory should make detailed inspection of all new purchased radio in those Regions having competent technicians. (This practice makes necessary a double checking for in most cases the sets have jarred out of adjustment in transient.) The elimination of this practice would make possible more time for research and design.

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11. Radio equipment procurement should be separately studied and steps taken to eliminate such objectionable features as placing of piece-meal orders with attendant ~~handling cost and~~ increased handling cost and higher initial prices, inability to interest reputable manufacturers in Forest Service ~~need~~ radio equipment production and lack of emergency stocks. ~~and maintain adequate service material stocks and lack of service and repair material stocks~~

12. Certain Regions also object to the present 7% handling charge levied by 26 Central purchase.

13. Consideration of the radio equipment problem ~~should~~ ment recognize the fact that the paper work associated with ~~the~~ such purchases is a minor part of the total activity. Constant contact has been necessary with the manufacturer and numerous technical questions must be answered during progress of the contract.

14. The tendency of those manufacturers with whom the Forest Service has dealt to "get by" with shortcuts, has made feral inspection a time consuming operation.

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The technical services of the laboratory must be integrated with the regular procurement unit in order to handle such ~~[illegible]~~ purchases successfully.

~~[illegible]~~

Insert on P 15

18. The Laboratory keep the field informed of proposed programs and the progress made on such programs at least twice each year.

16 ~~(14)~~ Coordinate telephone and radio and assign a greater burden to radio where such use will permit abandonment of long mileage seasonal use telephone lines carrying only a few phones.

17 ~~(15)~~ Determine the actual cost of telephone maintenance and provide funds to "maintain to original standard" all lines which are part of the basic yearlong system and key detection system trunk circuits.

Omit ~~(16)~~ That the Laboratory keep the field informed of proposed programs and at least twice a year progress being made on each program. Something similar to occasional papers published by the Experiment Stations. The proposed programs to be given to the field in detail.

19 ~~(17)~~ Establish positive control of communications through service-wide policy and Regional organization.

20 (18) Eliminate "personalized" telephone and radio systems and the effects of local attitude by well considered plans based on service-wide policy.

21 ~~(19)~~ Preserve the value of planning through controlled alterations and additions to telephone and radio systems.

22 ~~(20)~~ Standardize, service-wide, all telephone and radio accessories.

23 ~~(21)~~ Since the major source of telephone trouble now lies in the terminal equipment, i.e., instrument installations, switchboards, grounds, underground cable entrances, and similar items, it is recommended that those Regions desiring to take immediate steps toward improvement of the plant, start at this point. This recommendation does not imply that lines are faultless and do not need correction, but it does mean that our present plant is not being technically maintained and that lack of this kind of maintenance is the largest contributing factor to poor service.

24 ~~(22)~~ The matter of need for revision of the Telephone Handbook needs no further amplification. It appears desirable that a separate maintenance pocket type handbook be prepared. The usual handbook is an office device and unless memorized is of little value in field operations. The suggested pocket book would be liberally illustrated and give reasons and fundamentals as well as methods involved in maintenance problems.

25 ~~(23)~~ With the present increased use of planes and the ~~almost sure to come use~~ possible intensive use of the Helicopter type plane the need for radio from plane to ground becomes more urgent. Difficulty has so far been experienced in this type of communication, mostly because of antenna placement. The Laboratory should set up a project to get what data is now available from the armed forces and to carry on experiments if need be to a successful conclusion. We should not hazard life and limb of smoke jumpers without their ability to talk back to the plane or to a stationary set.

26 ~~(24)~~ And finally, radio has in our opinion reached the developed stage that it can well be taken out of the Jim Crack, the toy, the plaything class and placed into a useful and efficient tool, not only for fire control but for all administrative purposes and as such, other funds as well as fire control funds should be used in its purchase, installation and maintenance.

Conclusion

In R-5 and R-1 we prepared a report for each Region. This report was discussed with Regional Officers. A copy of each of these reports is attached. In R-6 our notes were discussed with a Regional Office group and in R-4 it being the last Region, the notes gathered to date were discussed with the Regional Forester previous to our field trip. He was informed that if we found anything different we would prepare a report, otherwise nothing further would be done until our final report was prepared.

We wish to acknowledge the full cooperation of all of the men associated with communications in all four Regions.

Respectfully submitted,

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